CLAIMS

1. An apparatus for multi-pathway impedance characterization and ablative treatment of tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

an impedance sensor array deployable from the elongated delivery device and configured to be coupled to at least one of an electromagnetic energy source or a switching device, the impedance array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, the plurality of resilient members defining a sample volume in the deployed state, at least one of the plurality of ~~resilient~~ members including an impedance sensor, at least a portion of the impedance array configured to sample tissue impedance through a plurality of conductive pathways;

an energy delivery device coupled to one of ~~the~~ sensor array, the at least one resilient member or the elongated delivery device, the energy delivery device including at least one RF electrode; and

an advancement member coupled to the impedance array, the advancement member including an actuable portion, the advancement member configured to control deployment of at least a portion of the array.

2. An apparatus for vector impedance characterization and ablative treatment of tumors:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

an impedance sensor array deployable from the elongated delivery device and configured to be coupled to at least one of an electromagnetic energy source or a switching device, the impedance array including a plurality of

resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, the plurality of resilient members defining a sample volume in the deployed state, at least one of the plurality of resilient members including an impedance sensor, at least a portion of the impedance array configured to measure an impedance vector within a selectable tissue site;

an energy delivery device coupled to one of the sensor array, the at least one resilient member or the elongated delivery device, the energy delivery device including at least one electrode or antenna; and

an advancement member coupled to the energy delivery device, the advancement member including an actuable portion, the advancement member configured to control deployment of at least a portion of the energy delivery device.

3. The apparatus of claim 1 or 2, wherein the plurality of resilient members includes a first, a second and a third resilient member.

4. The apparatus of claim 1 or 2, wherein the sensor has a resistance gradient or a resistance gradient configured to improve measurement of a complex impedance.

5. The apparatus of claim 4, wherein the resistance gradient is along a length of the sensor and configured compensate for resistive losses or hysteresis along the length of the sensor.

6. The apparatus of claim 1 or 2, at least a portion of the impedance arrays is configured to measure at least one of an intracellular impedance, an interstitial impedance or an intercellular capacitance.

7. The apparatus of claim 1 or 2, wherein the impedance array is configured to determine a locus of impedance within the sample volume.

8. The apparatus of claim 1 or 2, wherein the impedance array is configured to sample an impedance of at least a portion of the sample volume.

9. The apparatus of claim 8, wherein the at least a portion includes a first portion and a second portion.

10. The apparatus of claim 9, wherein the impedance array is configured to substantially simultaneously measure a first impedance profile of the first portion and second impedance profile of the second portion.

11. The apparatus of claim 1, wherein the plurality of conductive pathways are configured to be substantially evenly distributed or spaced within the sample volume.

12. The apparatus of claim 1, wherein the plurality of conductive pathways includes a first pathway and a second pathway.

13. The apparatus of claim 12, wherein the impedance array is configured to substantially simultaneously measure a first impedance of the first pathway and second impedance of the second pathway.

14. The apparatus of claim 12, the first pathway is positioned at a selectable angle relative to the second pathway.

15. The apparatus of claim 12, wherein the first and second pathway have no common segments.

16. The apparatus of claim 12, wherein the first and second pathway have a common origin.

17. The apparatus of claim 12, wherein the first and second pathway have substantially the same pathway, the second pathway being in an opposite direction to the first pathway.

18. The apparatus of claim 1 or 2, wherein the impedance array is configured to detect at an indicator of cell necrosis.

19. The apparatus of claim 1 or 2, wherein the impedance array is configured to detect at least one of a tissue ablation volume, a cell necrosis volume, a tissue thermal volume or a tissue hyperthermic volume.

20. The apparatus of claim 1 or 2, further comprising:

logic resources coupled to one of at least a portion of the impedance array, the energy delivery device, the switching device or the electromagnetic source, the logic resources including a processor.

21. The apparatus of claim 20, wherein one of the impedance array or logic resources is configured to measure or analyze tissue impedance or complex impedance at a measurement frequency distinct from an RF ablation frequency.

22. The apparatus of claim 20, wherein the logic resources are configured to identify a tissue condition or differentiate tissue responsive to an impedance signal from the at least a portion of the impedance array.

23. The apparatus of claim 22, wherein the logic resources are configured to analyze the signal at a frequency having an increased tissue condition sensitivity relative to a frequency spectrum.

24. The apparatus of claim 20, wherein the logic resources are configured to distinguish between normal and abnormal tissue, the abnormal tissue including at least one of abnormally mutated tissue, abnormally dividing tissue, cancerous tissue, metastatic tissue or hypoxic tissue.

25. The apparatus of claim 20, wherein the logic resources are configured to distinguish between necrosed and non-necrosed tissue.

26. The apparatus of claim 20, wherein the logic resources are configured to analyze at least one of an intracellular impedance, an interstitial impedance an intercellular capacitance or a complex impedance.

27. The apparatus of claim 20, wherein the logic resources are configured to identify one of an inflection point, an asymptote, a minimum or a maximum of an impedance signal.

28. The apparatus of claim 27, wherein the logic resources are configured to identify at least one of an endpoint, an amount of tissue injury or a tissue type utilizing at least one of the inflection point, the asymptote, the minimum or the maximum of the impedance signal.

29. The apparatus of claim 20, wherein the logic resources are configured to identify an endpoint for an ablation procedure responsive to an impedance signal from the at least a portion of the impedance array.

30. The apparatus of claim 22, wherein the impedance signal includes at least one of an intracellular impedance, an interstitial impedance an intercellular capacitance or a complex impedance, the logic resources configured to identify a tissue condition utilizing at least one of an impedance

ratio including at least one of interstitial to intercellular impedance, real to imaginary impedance or impedance to capacitance.

31. The apparatus of claim 22, wherein the impedance signal is a complex impedance and the logic resources are configured to identify a tissue condition of the sample volume utilizing real and imaginary components of the complex impedance signal.

32. The apparatus of claim 20, wherein the impedance array is configured to substantially simultaneously measure an impedance of a first tissue volume portion and a second tissue volume portion and the logic resources are configured to compare the impedance of the first portion to an impedance of the second portion.

33. The apparatus of claim 2, the impedance array is configured to detect real and imaginary components of the impedance vector or magnitude and phase angle of the impedance vector.

34. An apparatus for multi-pathway impedance characterization and ablative treatment of tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

an impedance sensor array deployable from the elongated delivery device and configured to be coupled to at least one of an electromagnetic energy source or a switching device, the impedance array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, the plurality of resilient members defining a sample volume in the deployed state, at least one of the plurality of resilient members including

an impedance sensor, at least a portion of the impedance array configured to sample tissue impedance through a plurality of conductive pathways; and

an energy delivery device coupled to one of the sensor array, the at least one resilient member or the elongated delivery device, the energy delivery device including at least one electrode or antenna.

35. An apparatus for complex impedance characterization of tumors, the apparatus comprising:

an introducer including a lumen, the introducer being maneuverable in tissue; and

an impedance sensor array positionable in the introducer in a compacted state and deployable from the introducer to define a sample volume in a deployed state, the impedance array configured to be coupled to at least one of an electromagnetic energy source, logic resources or a switching device, the impedance array defining a sample volume, in a deployed state, at least a portion of the impedance array configured to sample a complex tissue impedance through a plurality of conductive pathways ~~and~~ detect or measure an indicator of at least one of tumorous tissue or cell necrosis.

36. The apparatus of claim 35, wherein the impedance array includes a sensor, the sensor having one of a resistance gradient or a resistance gradient configured to improve measurement of a complex impedance.

37. An apparatus for impedance characterization and frequency directed RF ablative treatment of tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

an impedance sensor array deployable from the elongated delivery device and configured to be coupled to at least one of an electromagnetic energy source or a switching device, the impedance array including a plurality of resilient members, at least one of the plurality of resilient members being

positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, the plurality of resilient members defining a sample volume in the deployed state, at least one of the plurality of resilient members including an impedance sensor; and

an energy delivery device coupled to one of the sensor array, the at least one resilient member or the elongated delivery device, the energy delivery device including a plurality of RF electrodes configured to generate a directional ablation zone responsive to an RF frequency.

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